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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/074,141	02/11/2002	Rajeev Bajaj	AMAT/6228/CPI/EC/PJS	6612

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APPLIED MATERIALS, INC.
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EXAMINER

WONG, EDNA

ART UNIT	PAPER NUMBER
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1753

DATE MAILED: 06/09/2003

41

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/074,141

Applicant(s)

BAJAJ ET AL.

Examiner

Edna Wong

Art Unit

1753

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-40 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-40 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2,3.
- 4) ☐ Interview Summary (PTO-413) Paper No(s) ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

Claim Rejections - 35 USC § 112

I. Claims **1-19** are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for electrochemical plating methods, does not reasonably provide enablement for electroless plating methods. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to carry out the invention commensurate in scope with these claims.

The specification discloses electroplating solutions. The electroplating solutions are used in an electroplating system as shown in Fig. 1 (specification, page 5, ¶ [0015]). Thus, it appears that the methods of claims 1-19 are electrochemical plating methods, and not electroless plating methods, unless proven otherwise.

II. Claims **1-2, 5-7, 10-12, 15-18 and 29-30** are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for electroplating copper, does not reasonably provide enablement for electroplating gold. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to carry out the invention commensurate in scope with these claims.

The specification discloses copper plating solutions (page 6, ¶ [0017]) and discloses that the electroplating solution may further include one or more additives. The additives are known in the art (page 6, ¶ [0017]). Thus, it appears that the plating solution in claims 1-3, 5-7, 10-12, 15-18 and 29-30 are copper plating solutions and that

the additives are from the copper electroplating art, unless proven otherwise.

Furthermore, could one use the same additives used in a gold electroplating bath in a copper electroplating bath?

III. Claims **1-28 and 37** are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1

lines 1-5, the preamble of the claim recites "A method of plating copper on a substrate". However, the body of the claim does not recite any copper being plated onto a substrate. Thus, the body of the claim is inconsistent with its preamble.

Claim 8

line 9, "the metal" lacks antecedent basis.

Claim 11

line 9, the word "plating" should be amended to the word -- electroplating -- because there is an anode in the plating solution and there is no electrical bias positively applied in the method.

line 9, it appears that the "metal ions" are the same as those recited in claim 11,

line 4. However, it is unclear if they are. If they are, then it is suggested that the word -- the -- be inserted after the word "plating".

Claim 20

line 4, it appears that "a substrate" is the same as that recited in claim 20, line 2. However, it is unclear if it is.

Claim 37

lines 1-2, it appears that "a copper sulfate solution" is further limiting the plating solution recited in claim 35, line 3; and the "copper ions" are further limiting the copper source recited in claim 35, line 3. However, it is unclear if they are.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Methods

- I. Claim 1 is rejected under 35 U.S.C. 102(b) as being anticipated by **Feldstein** (US Patent No. 4,282,271).

Feldstein teaches a method of plating copper on a substrate, comprising the step of:

adding an anti-oxidant (col. 4, lines 29-46) to a plating solution (= a colloid of a non-precious metal) [col. 4, line 64 to col. 5, line 2] in an amount effective to reduce degradation of organic additives in the plating solution (= 0.1 M sucrose, col. 7, solution 4; and 12 g/l sodium lignosulfonate, col. 11, line 40),

wherein the anti-oxidant is hydroquinone (col. 4, lines 29-46).

The plating solution is configured to support copper plating (col. 4, lines 64-67).

The plating solution includes copper ions in a concentration of between about 5 g/l and about 100 g/l (= 15 g/l) [col. 5, lines 36-43].

- II. Claims **11 and 13-14** are rejected under 35 U.S.C. 102(b) as being anticipated by **EP 402,896**.

The EP reference teaches a method for plating metal on a substrate comprising the step of:

(a) disposing the substrate (= Hull cell panels) [page 3, Example 1] and an anode (page 3, line 1) in a plating solution, the plating solution comprising:

(i) metal ions (= copper sulfate) [page 7, line 6];

(ii) an organic additive configured to enhance one or more plating

characteristics (= grain refiner) [page 2, lines 31-35]; and

(iii) an anti-oxidant (= transition metal) in an amount effective to reduce degradation of the organic additive (page 2, lines 29-30); and

(b) plating metal ions from the plating solution onto the substrate (= bright Hull Hull panels were produced) [page 3, Example 1].

The metal ions comprise copper (= copper sulfate) [page 7, line 6].

The metal ions comprise copper in a concentration between about 5 g/l and about 100 g/l (= 80 g/l copper sulfate) [page 7, line 6].

The metal ions comprise copper in a concentration between about 5 g/l and about 100 g/l (= 80 g/l copper sulfate) [page 7, line 6].

III. Claims **1 and 3-4** are rejected under 35 U.S.C. 102(e) as being anticipated by **Naoi et al.** (US Patent Application Publication No. 2003/0059634).

Naoi teaches a method for plating copper on a substrate, comprising the step of: adding an anti-oxidant (= sodium stannate) to a plating solution in an amount (= 15 g/l) effective to reduce degradation of organic additives in the plating solution, the anti-oxidant is sodium stannate (page 23, Example 21).

The plating solution is configured to support copper plating (page 23, ¶ [0361] to [0362]).

The plating solution includes copper ions in a concentration of between about 5 g/l and about 100 g/l (= 15 g/l copper cyanide) [page 10, ¶ [0361]].

IV. Claims **11 and 13-15** are rejected under 35 U.S.C. 102(e) as being anticipated by **Naoi et al.** (US Patent Application Publication No. 2003/0059634).

Naoi teaches a method for plating metal on a substrate, comprising the steps of:

(a) disposing the substrate (= a base article of a watchband) and an anode (page 3, line 1) in a plating solution, the plating solution comprising:

(i) metal ions (= copper cyanide);

(ii) an organic additive configured to enhance one or more plating characteristics (= brightener); and

(iii) an anti-oxidant (= sodium stannate) in an amount effective to reduce degradation of the organic additive (page 23, Example 21); and

(b) plating metal ions from the plating solution onto the substrate (page 23, ¶ [0363]).

The metal ions comprise copper (= copper cyanide) [page 23, ¶ [0361]].

The metal ions comprise copper in a concentration between about 5 g/l and about 100 g/l (= 15 g/l copper cyanide) [page 23, ¶ [0361]].

Composition

V. Claims **20-22 and 28** are rejected under 35 U.S.C. 102(b) as being anticipated by **EP 402,896**.

The EP reference teaches a plating solution for an electrochemical plating system comprising:

- (a) a liquid solution containing copper ions to be plated on a substrate;
- (b) an organic additive configured to facilitate a plating characteristic of the copper ions onto a substrate (= grain refiner) [page 2, lines 31-35]; and
- (c) an anti-oxidant (= transition metal) in an amount sufficient to reduce the degradation of the organic additive (page 2, lines 29-30) in the plating solution.

The liquid solution comprises copper sulfate (page 7, line 6).

The copper ions are at a concentration between about 5 g/l and about 100 g/l (= 80 g/l copper sulfate) [page 7, line 6].

The plating solution further comprises chloride ions (= hydrochloric acid) [page 7, line 8].

The organic plating additive comprises an accelerator (= brightener = grain refiner) [page 2, lines 31-35].

The plating solution further comprises an acid (= 110 ml/l sulfuric acid) [page 7, line 7].

VI. Claims **20, 22, 25 and 28** are rejected under 35 U.S.C. 102(e) as being anticipated by **Naoi et al.** (US Patent Application Publication No. 2003/0059634).

Naoi teaches a plating solution for an electrochemical plating system, comprising:

- (a) a liquid solution containing copper ions (= copper cyanide) to be plated on a substrate;

(b) an organic additive (= brightener) configured to facilitate a plating characteristic of the copper ions onto a substrate; and

(c) an anti-oxidant (= sodium stannate) in an amount sufficient to reduce the degradation of the organic additive in the plating solution (page 23, Example 21).

The copper ions are at a concentration between about 5 g/l and about 100 g/l (= 15 g/l copper cyanide) [page 23, ¶ [0361]].

The anti-oxidant is sodium stannate (page 23, ¶ [0361]).

The organic plating additive is an accelerator (= brightener) (¶ [0361]).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Method

I. Claims **2-4, 7 and 10** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Feldstein** (US Patent No. 4,282,271) as applied to claim 1 above.

Feldstein is as applied above and incorporated herein.

Feldstein does not teach wherein a concentration of the anti-oxidant is between about 500 ppm and about 5000 ppm; wherein the amount of anti-oxidant added into the

plating solution per unit time is calculated to correspond to an amount of organic additives degrading on the plating solution per unit time; and disposing of the entire plating solution after a period of time and replacing the plating solution.

However, the invention as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made because one skilled in the art would have been motivated to have modified the method of Feldstein with wherein a concentration of the anti-oxidant is between about 500 ppm and about 5000 ppm because the concentration of the anti-oxidant is a result-effective variable and one skilled in the art has the skill to calculate the concentration that would determine the success of the desired reaction to occur, i.e., the anti-oxidizing reaction, absent evidence to the contrary. MPEP § 2141.03 and § 2144.05(b).

As to wherein the amount of anti-oxidant added into the plating solution per unit time is calculated to correspond to an amount of organic additives degrading on the plating solution per unit time, it is well within the skill of the artisan to replenish the amount of anti-oxidant in the solution that is depleted in the plating process. This would have kept the bath at an optimum performance level during the plating.

As to disposing of the entire plating solution after a period of time and replacing the plating solution, it is well within the skill of the artisan to discard the used plating

solution and replace it with a new one. It appears that a plating solution would have a certain lifetime, and after that, it would need to have been replaced.

II. Claim **12** is rejected under 35 U.S.C. 103(a) as being unpatentable over **EP 402,896** as applied to claims 11 and 13-14 above.

The EP reference is as applied above and incorporated herein.

The EP reference does not teach disposing of the entire plating solution after a period of time and replacing the plating solution.

However, the invention as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made because one skilled in the art would have been motivated to have modified the method of the EP reference by disposing of the entire plating solution after a period of time and replacing the plating solution because it is well within the skill of the artisan to discard the used plating solution and replace it with a new one. It appears that a plating solution would have a certain lifetime, and after that, it would need to have been replaced.

III. Claims **7 and 10** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Naoui et al.** (US Patent Application Publication No. 2003/0059634) as applied to claims 1 and 3-4 above.

Naoi is as applied above and incorporated herein.

Naoi does not teach wherein the amount of anti-oxidant added into the plating solution per unit time is calculated to correspond to an amount of organic additives degrading on the plating solution per unit time; and disposing of the entire plating solution after a period of time and replacing the plating solution.

However, the invention as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made because one skilled in the art would have been motivated to have modified the method of Naoi with wherein the amount of anti-oxidant added into the plating solution per unit time is calculated to correspond to an amount of organic additives degrading on the plating solution per unit time because it is well within the skill of the artisan to replenish the amount of anti-oxidant in the solution that is depleted in the plating process. This would have kept the bath at an optimum performance level during the plating.

As to disposing of the entire plating solution after a period of time and replacing the plating solution, it is well within the skill of the artisan to discard the used plating solution and replace it with a new one. It appears that a plating solution would have a certain lifetime, and after that, it would need to have been replaced.

IV. Claims **12 and 16** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Naoi et al.** (US Patent Application Publication No. 2003/0059634) as applied to claims 11 and 13-15 above.

Naoi is as applied above and incorporated herein.

Naoi does not teach disposing of the entire plating solution after a period of time and replacing the plating solution; and wherein the anti-oxidant is sodium stannate at a concentration of between about 500 ppm and about 5000 ppm.

However, the invention as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made because one skilled in the art would have been motivated to have modified the method of Naoi by disposing of the entire plating solution after a period of time and replacing the plating solution because it is well within the skill of the artisan to discard the used plating solution and replace it with a new one. It appears that a plating solution would have a certain lifetime, and after that, it would need to have been replaced.

As to wherein the anti-oxidant is sodium stannate at a concentration of between about 500 ppm and about 5000 ppm, the concentration of the anti-oxidant is a result-effective variable and one skilled in the art has the skill to calculate the concentration that would determine the success of the desired reaction to occur, i.e., the anti-oxidizing

reaction, absent evidence to the contrary. MPEP § 2141.03 and § 2144.05(b).

V. Claims **29-32** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Naoi et al.** (US Patent Application Publication No. 2003/0059634).

Naoi teaches a method for reducing degraded organic plating additives in an electrochemical plating solution, comprising the step of:

adding sodium stannate to the electrochemical plating solution, the solution added in an amount (page 23, ¶ [0361]).

The electrochemical plating solution is configured to support copper plating (page 23, ¶ [0361] to [0362]).

The electrochemical plating solution includes copper ions in a concentration of between about 5 g/l and about 100 g/l (= 15 g/l copper cyanide) [page 10, ¶ [0361]].

Naoi does not teach wherein the concentration of sodium stannate is between about 500 ppm and about 5000 ppm; and wherein the sodium stannate is added in an amount corresponding to a time varying amount of degraded organic plating additives generated in the electrochemical plating solution.

However, the invention as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made because one skilled in the art would have been motivated to have modified the method of Naoi with wherein the

concentration of sodium stannate is between about 500 ppm and about 5000 ppm because the concentration of the sodium stannate is a result-effective variable and one skilled in the art has the skill to calculate the concentration that would determine the success of the desired reaction to occur, i.e., the anti-oxidizing reaction, absent evidence to the contrary. MPEP § 2141.03 and § 2144.05(b).

As to wherein the sodium stannate is added in an amount corresponding to a time varying amount of degraded organic plating additives generated in the electrochemical plating solution, it is well within the skill of the artisan to replenish the amount of sodium stannate in the solution that is depleted in the plating process. This would have kept the bath at an optimum performance level during the plating.

VI. Claims **35-36 and 40** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Naoi et al.** (US Patent Application Publication No. 2003/0059634).

Naoi teaches a method for plating copper in an electrochemical plating system, comprising the step of:

contacting a substrate having an electrical bias applied thereto with a plating solution,

wherein the plating solution comprises:

- (a) a copper source (= copper cyanide);
- (b) an organic additive (= brightener); and

(c) an anti-oxidant of sodium stannate (page 23, Example 21).

The plating solution includes copper ions wherein the copper ions are in a concentration of between about 5 g/l and about 100 g/l (= 15 g/l copper cyanide) [page 23, ¶ [0361)].

Naoi does not teach wherein the concentration of sodium stannate is between about 500 ppm and about 5000 ppm; wherein the copper ions are supplied by a copper sulfate solution; and wherein the amount of anti-oxidant added into the plating solution per unit time is calculated to correspond to an amount of organic additives degrading on the plating solution per unit time.

However, the invention as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made because one skilled in the art would have been motivated to have modified the method of Naoi with wherein the concentration of sodium stannate is between about 500 ppm and about 5000 ppm because the concentration of the anti-oxidant is a result-effective variable and one skilled in the art has the skill to calculate the concentration that would determine the success of the desired reaction to occur, i.e., the anti-oxidizing reaction, absent evidence to the contrary. MPEP § 2141.03 and § 2144.05(b).

As to wherein the copper ions are supplied by a copper sulfate solution, copper

sulfate is a conventional copper ion source. Substitution of the copper cyanide disclosed by Naoi with copper sulfate would have been functionally equivalent, absent evidence to the contrary.

As to wherein the amount of anti-oxidant added into the plating solution per unit time is calculated to correspond to an amount of organic additives degrading on the plating solution per unit time, it is well within the skill of the artisan to replenish the amount of anti-oxidant in the solution that is depleted in the plating process. This would have kept the bath at an optimum performance level during the plating.

Composition

VII. Claims **23 and 24** are rejected under 35 U.S.C. 103(a) as being unpatentable over **EP 402,896** as applied to claims 20-22 and 28 above.

The EP reference is as applied above and incorporated herein.

The EP reference does not teach wherein the chloride ions are at a concentration of between about 10 ppm and about 200 ppm; and wherein the acid is at a concentration of between about 5 g/l and about 200 g/l.

However, the invention as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made because one skilled in the art

would have been motivated to have modified the plating solution of the EP reference with wherein the chloride ions are at a concentration of between about 10 ppm and about 200 ppm because the chloride ions concentration is a result-effective variable and one skilled in the art has the skill to calculate the concentration that would determine the success of the desired reaction to occur, e.g., the interaction with the brightener to produce bright, ductile copper deposits, absent evidence to the contrary. MPEP § 2141.03 and § 2144.05(b).

As to wherein the acid is at a concentration of between about 5 g/l and about 200 g/l, the acid concentration is a result-effective variable and one skilled in the art has the skill to calculate the concentration that would determine the success of the desired reaction to occur, e.g., absent evidence to the contrary. MPEP § 2141.03 and § 2144.05(b).

The EP reference teaches 110 ml/l of sulfuric acid (page 7, line 7).

VIII. Claims **21 and 26** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Naoi et al.** (US Patent Application Publication No. 2003/0059634) as applied to claims 20, 22, 25 and 28 above.

Naoi is as applied above and incorporated herein.

Naoi does not teach wherein the liquid solution comprises copper sulfate; and

wherein the anti-oxidant is at a concentration of between about 500 ppm and about 5000 ppm.

However, the invention as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made because one skilled in the art would have been motivated to have modified the plating solution of Naoi with wherein the liquid solution comprises copper sulfate because copper sulfate is a conventional copper ion source. Substitution of the copper cyanide disclosed by Naoi with copper sulfate would have been functionally equivalent, absent evidence to the contrary.

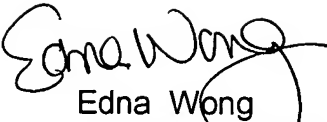
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Edna Wong whose telephone number is (703) 308-3818. The examiner can normally be reached on Mon-Fri 7:30 am to 5:00 pm, alt. Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on (703) 308-3322. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 873-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-1495.

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Edna Wong
Primary Examiner
Art Unit 1753

EW
June 5, 2003